

## Electrolyte Disturbances and Cardiac Complications in Post Operative Patients

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**Abstract:**

**Background:** Normal cardiac function is contingent on electrolyte balance. Post-surgical changes, including surgical stress, fluid shifts, blood loss, anesthetic agents, and alterations in renal function, make the post-operative period highly vulnerable to electrolyte disturbances. Such disturbances may grossly affect cardiac electrophysiology, resulting in arrhythmias and other cardiac complications. It becomes, therefore, imperative that early recognition and correction of electrolyte disturbances are necessary in reducing both morbidity and mortality during this period.

**Objectives:** The study aimed to determine the prevalence of electrolyte disturbances in post-operative patients and their relationship with cardiac complications during the early post-operative period.

**Materials and Methods:** A total of 176 patients were enrolled in the prospective observational study conducted over a period of one year in a tertiary care hospital. A consecutive sampling technique was used. Measurement of serum electrolytes, namely sodium, potassium, calcium, and magnesium, was done within 72 hours following surgery. Cardiac complications were recorded based on clinical assessment with the aid of electrocardiography. Data analysis was done by descriptive statistics and association of electrolytes with cardiac complication using the Chi-square test, having a p-value <0.05 as statistically significant.

**Results:** Electrolyte imbalance was a common finding in post-operative patients, and the most common imbalance was hyponatremia and hypokalemia. Cardiac complications, especially arrhythmias, occurred relatively often in patients who had electrolyte imbalance. The odds ratio for cardiac complications was highest for hypokalemia, followed by hyponatremia and then hypocalcemia. Cardiac complications occurred significantly less often in patients who had normal electrolyte values.

**Conclusion** Electrolyte imbalance is common in the postoperative period and is independently related to cardiac complications. Electrolyte imbalance in the postoperative period must be closely monitored and corrected in order to prevent cardiac morbidity.

**Keywords:** Electrolyte Disturbances, Post-Operative Patients, Cardiac Complications, Arrhythmias, Hypokalemia, Hyponatremia, Electrocardiographic Changes.

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**Introduction**

Electrolytes are an essential component in the preservation of normal physiology and are particularly important in the regulation of electrophysiology in the heart. The role of sodium, potassium, calcium, and magnesium in maintaining the physiology of the heart is well recognized [1]. Electrolyte imbalance in the post-operative patient is a concept commonly observed in patients subjected to a variety of stress responses post-operatively. Such irregularities are caused by the withholding of fluids in the body through fasting or blood loss [2].

The postoperative period can also be considered a high-risk interval for patients potentially facing

complications related to metabolism and cardiovascular events [3]. Trauma from surgery triggers neuroendocrine mechanisms of stress, and an increase in catecholamine, cortisol, and antidiuretic hormones can result in profound disturbances of electrolyte balance [4]. Contributing factors also include the following: high surgery times, high tissue handling, high use of diuretics, intravenous fluids, and transfusion of blood products in patients undergoing surgery. Elderly and compromised patients face a high risk for these complications [5].

Electrolyte imbalances, especially potassium, sodium, calcium, and magnesium deficiencies or excesses, affect cardiac function seriously [6]. Hypokalemia and hyperkalemia are known to cause potentially fatal arrhythmias; besides, hypokalemia can cause hemodynamic instability and changes in consciousness [7]. Hypocalcemia and hypomagnesemia are known to cause prolongation of QT intervals, ventricular arrhythmias, and reduced contractility of the heart. These cardiac complications are known to increase post-operative complications and prolong hospital stays or admissions to critical care units [8].

Despite recent improvements in surgical and post-operative management, disturbances of electrolytes are still often overlooked in the post-operative setting. Continuous cardiac monitoring and measurement of electrolyte levels are, therefore, necessary for early detection and prompt management [9]. Recognition of the link between electrolyte imbalance and cardiac complications is vital for maximizing post-operative management [10].

The aim of the current study is to analyze the prevalence and trend of electrolyte imbalance in post-operative patients in relation to cardiovascular complications in order to highlight the importance of early detection and proper management to prevent post-operative cardiovascular events.

### Methodology

**Study Design and settings:** This has been a prospective observational study to evaluate disturbances in electrolytes and complications of cardiac origin in post-operative patients. The study was performed on the post-operative wards and surgical intensive care unit in a tertiary care hospital, which offers comprehensive surgical and intensive care services.

**Study Population and Duration:** The target population was adult patients who had under-taken major surgical operations, requiring admission for monitoring following surgery. The study period was one year, which gave enough time for patient recruitment and data analysis.

**Sample Size and Technique:** In all, 176 patients were selected for the post-operative phase based on hospital admission rates and the feasibility of the study. A consecutive sampling approach was adopted in this study, where all eligible patients post-operation and under the defined inclusion criteria were selected.

### Inclusion Criteria:

- Patients aged 18 years and above
- Patients having elective or emergency surgery
- Patients Admitted after Operative Procedures for at Least 48 Hours
- Participants who consented in the study

### Exclusion Criteria:

- Patients with pre-existing electrolyte imbalances
- Patients with known chronic renal failure and/or dialysis
- Patients who have chronic cardiac arrhythmias prior to surgery
- Patients receiving electrolyte correction therapy pre-operatively

**Data Collection:** Data was obtained using a structured proforma containing demographic information, type and duration of surgery, presence of comorbid conditions, serum levels of electrolytes, and findings from cardiac monitoring. Serum electrolytes (sodium, potassium, calcium, and magnesium) were estimated in the first 72 hours after operation.

**Study Procedure:** The post-operative patients were observed both clinically and electrocardiographically. Should there be any complications regarding the heart, like arrhythmias or conduction problems, they were recorded. The relation between electrolyte imbalance and cardiac effects was noted.

**Statistical Analysis:** The data was entered into Microsoft Excel and analyzed using statistical software. Descriptive statistical methods such as frequency and percentage were employed. The association between disturbances of electrolytes and cardiac complications was compared using the Chi-square test, with a p-value of <0.05 taken as significant.

**Ethical Clearance:** The study had got ethical clearance from the Institutional Ethics Committee. Informed consent was sought from all the study participants. Participant confidentiality was upheld.

### Results

Table 1 shows that the most of the participants in the study were from the age groups 41–60 years, indicating a higher prevalence in middle-aged adults. Male patients were more predominant than females within the study population. The majority of surgeries were elective, suggesting that planned surgical admissions were more common compared to emergency interventions.

**Table 1: Demographic Distribution of Study Participants (n = 176)**

Variable	Category	Number of Patients	Percentage (%)
Age (years)	18-40	58	33.0
	41-60	72	40.9
	>60	46	26.1
Gender	Male	102	58.0
	Female	74	42.0
Type of Surgery	Elective	118	67.0
	Emergency	58	33.0

Table 2 shows that the participants belonged to the categories of 41-60 years, pointed towards the fact that there was a greater prevalence of the disease in the middle-aged group of people. Male patients

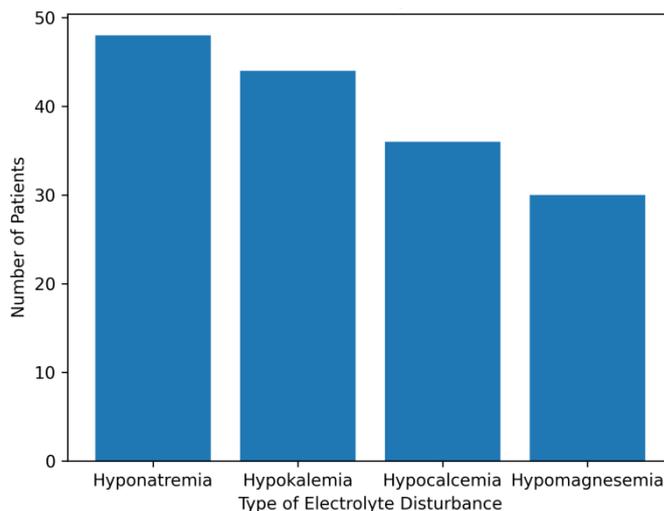
dominated the female counterparts in the demographic data. A major section of the surgery procedures performed on patients belonged to the category of elective surgery.

**Table 2: Prevalence of Electrolyte Disturbances in Post-operative Patients**

Electrolyte	Normal	Decreased	Increased
Sodium	112 (63.6%)	48 (27.3%)	16 (9.1%)
Potassium	118 (67.0%)	44 (25.0%)	14 (8.0%)
Calcium	130 (73.9%)	36 (20.5%)	10 (5.6%)
Magnesium	138 (78.4%)	30 (17.0%)	8 (4.6%)

Figure 1 depicts the various electrolyte disturbances among postoperative patients. Hyponatremia is the most common electrolyte disturbance followed by hypokalemia. Hypocalcemia and hypomagnesemia are observed at a comparable lower frequency yet clinically significant. The predominance of sodium

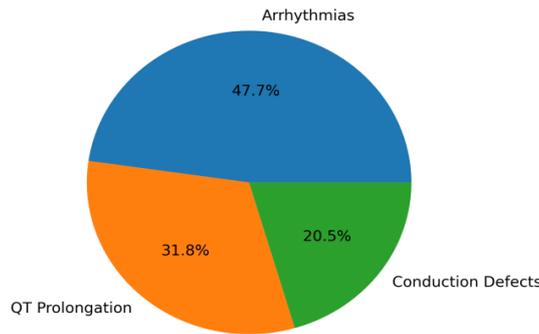
and potassium disturbances underlines their vulnerability to the fluid shifts and stress responses. These findings emphasize the importance of vigilant monitoring of electrolytes in the post-operative period to prevent complications.



**Figure 1: Distribution of Electrolyte Balance**

Figure 2 shows the percentage distribution of cardiac complications shown in post-operative patients. The most prevalent complication is arrhythmias, at about half of the cases. About one-quarter of the cases were shown to have a

prolongation of QT, which is indicative of significant electrical instability of the myocardium. Conduction defects were less frequently manifested, but they are clinically important because of their potential for adverse outcomes.



**Figure 2: Proportion of Cardiac Complications**

The correlation of electrolyte imbalance and cardiac complication in post-operative patients is evident in Table 3. The highest correlation with cardiac complication was in patients with hypokalemia, emphasizing its relationship with cardiac instability.

Hyponatremia and hypocalcemia were other electrolytes with high correlations with cardiac events. Although low in correlation, hypomagnesemia is also worth considering in cardiac complications.

**Table 3: Association Between Electrolyte Disturbances and Cardiac Complications**

Electrolyte Disturbance	Patients with Cardiac Complications	Patients without Complications
Hyponatremia	30	18
Hypokalemia	34	10
Hypocalcemia	22	14
Hypomagnesemia	16	14

**Discussion**

This study demonstrates that electrolyte imbalance is very prevalent in the post-operative setting, as is its strength of association as an outcome for cardiac events. Hyponatremia and hypokalemia are found to be the two mostly encountered values in this study, as found in previous studies conducted in other surgical and ICU units as well [11,12]. Previous studies have shown that fluid shifts, hormonal changes secondary to surgical stress, and alterations in renal function are predisposing to both sodium and potassium disorders in the early post-operative period [13,14].

In the recent study, the condition that had the strongest relation with cardiac complications such as arrhythmias was found to be hypokalemia. This tendency is consistent with previous finding regarding the effect of decreased levels of potassium in the body as it has the ability to make the heart more excitable and thereby lead to the possibility of developing arrhythmias [15]. Previous studies have also found such tendencies in patients who have undergone major surgeries such as abdominal and cardiac surgeries [16,17].

The incidence of hyponatremia was the second most frequent electrolyte imbalance, and again, there was a significant connection with complications within the cardiovascular system. It has been postulated in previous study that hyponatremia due to over-

administration of hypotonic fluids and over-secretion of ADH has a high incidence in postoperative patients [18]. Although hyponatremia has generally been viewed as less arrhythmogenic than abnormalities in potassium, there is still a possibility that hyponatremia may lead to cardiovascular instability and may worsen existing cardiovascular disease.

Hypocalcemia and hypomagnesemia, although not common in the current study, were related to QT prolongation and conduction disorders. These results are in keeping with previous literature, which have noted the importance of both calcium and magnesium in myocardial repolarization and stability [19]. The older literature stresses the significance of mild electrolyte disturbances in predisposing to life-threatening ventricular arrhythmias, especially in critical illnesses.

Overall, the results of the current study support the previous literature and stress the relevance of performing electrolyte analysis on a routine basis after a surgical procedure. Early diagnosis and timely treatment of electrolyte disturbance may decrease the incidence of cardiac complications.

**Conclusion**

In conclusion, electrolyte abnormalities are frequent in post-operative patients and represent a major risk factor for the occurrence of cardiac events. The findings from the current study confirm the

association of abnormalities in sodium, potassium, calcium, and magnesium blood levels with arrhythmias and other cardiac events. Hyperkalemia is found to be a major risk factor for the occurrence of cardiac events. Hyperkalemia is associated with an increased risk of cardiac events in the post-operative setting. Early recognition and correction of electrolyte disturbances could be an important factor in improving the outcome in post-operative patients.

### Limitations

The study was performed at a single tertiary care center, so its results are not generalizable. The observational design cannot support any conclusion of the causal link of electrolyte disturbances to cardiac complications. Long-term cardiac outcomes after discharge were not followed.

### Recommendations

Routine and frequent monitoring of serum electrolytes should be included in post-operative care. Early correction of electrolyte disturbances, especially abnormalities in potassium and sodium levels, is recommended. Future studies conducted in multiple centers with greater sample sizes and long-term follow-up would add strength to the evidence and provide clinical guidelines.

### References

- Stephenson, Christopher, et al. "Management of common postoperative complications." *Mayo Clinic Proceedings*. Vol. 95. No. 11. Elsevier, 2020.
- Mukartihal, Ravikumar, et al. "Electrolyte imbalance after total joint arthroplasty: risk factors and impact on length of hospital stay." *European Journal of Orthopaedic Surgery & Traumatology* 29.7 (2019): 1467-1472.
- Mohammed, Mahmoud Jassim, and Saad Hussein Murad. "Fluid and Electrolyte Alteration for Post-Surgical (ICU) Patients'."
- Lopes, Leilani A., and Devendra K. Agrawal. "Post-operative atrial fibrillation: current treatments and etiologies for a persistent surgical complication." *Journal of surgery and research* 5.1 (2022): 159.
- Adami, Chiara, et al. "Prevalence of electrolyte disturbances and perianesthetic death risk factors in 120 horses undergoing colic surgery." *Journal of Equine Veterinary Science* 84 (2020): 102843.
- Rezaei, Yousef, et al. "Postoperative atrial fibrillation following cardiac surgery: from pathogenesis to potential therapies." *American Journal of Cardiovascular Drugs* 20.1 (2020): 19-49.
- Howitt, Samuel H., et al. "Are serum potassium and magnesium levels associated with atrial fibrillation after cardiac surgery?." *Journal of Cardiothoracic and Vascular Anesthesia* 34.5 (2020): 1152-1159.
- Rafaqat, Saira, et al. "Electrolyte's imbalance role in atrial fibrillation: pharmacological management." *International Journal of Arrhythmia* 23.1 (2022): 15.
- Berardi, Rossana, et al. "Electrolyte disorders in cancer patients: a systematic review." *Journal of Cancer Metastasis and Treatment* 5 (2019): N-A.
- Omar, Alaa, et al. "Perioperative risk factors predisposing to atrial fibrillation after CABG surgery." *The Heart Surgery Forum*. Vol. 24. No. 2. IMR Press, 2021.
- Reumkens, Ankie, et al. "Electrolyte disturbances after bowel preparation for colonoscopy: Systematic review and meta-analysis." *Digestive Endoscopy* 34.5 (2022): 913-926.
- SADEGHI, BOJD SIMIN, et al. "Electrolyte disturbances in PICU: a cross sectional study." (2019): 0-0.
- Bereket, Abdullah. "Postoperative and long-term endocrinologic complications of craniopharyngioma." *Hormone research in paediatrics* 93.9-10 (2020): 497-509.
- Miles, Clifford D., and Scott Gregory Westphal. "Electrolyte disorders in kidney transplantation." *Clinical Journal of the American Society of Nephrology* 15.3 (2020): 412-414.
- Boriani, Giuseppe, et al. "European Heart Rhythm Association (EHRA) consensus document on management of arrhythmias and cardiac electronic devices in the critically ill and post-surgery patient, endorsed by Heart Rhythm Society (HRS), Asia Pacific Heart Rhythm Society (APHS), Cardiac Arrhythmia Society of Southern Africa (CASSA), and Latin American Heart Rhythm Society (LAHRS)." *Ep Europace* 21.1 (2019): 7-8.
- Qureshi, Mashal, et al. "Determinants of atrial fibrillation after cardiac surgery." *Reviews in Cardiovascular Medicine* 22.2 (2021): 329-341.
- Al-Ramadan, Ali, et al. "Morbidity and mortality of ondansetron in patients with non-congenital long QT syndrome: a review article." *Cardiovascular Drugs and Therapy* (2025): 1-8.
- Moh'd, Ashraf Fadel, et al. "Postoperative Cardiac Arrest in Cardiac Surgery—How to Improve the Outcome? *Medical Archives* 75.2 (2021): 149.
- Galway, Ursula, et al. "Perioperative challenges in management of diabetic patients undergoing non-cardiac surgery." *World journal of diabetes* 12.8 (2021): 1255.